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Heliotropic tone.—PRINGSHEIM discusses in a long and rather technical paper the influence of illumination upon heliotropic tone.[9] By heliotropic tone he means that internal condition of responsiveness which determines the position of the cardinal points of reaction—the liminal and optimal illumination both for positive and negative response, and the indifferent zone. He shows that the reaction time of heliotropic plants diminishes with increasing intensity of light, rapidly at first, then more slowly and finally becomes constant. Beyond this a false optimum (really temporary indifference) is reached, but only in plants grown in the dark. If such plants, however, after being taken from the dark are rotated for a time in a light to which they will later react, the indifference disappears and the reaction, contrary to the earlier statements, is actually accelerated. This reaction, by a plant attuned to a certain light, is indeed the speediest possible at that intensity. In fact during the first part of the illumination of a plant of low heliotropic tone, the direction of the light is of no significance; for whether rotated or even illuminated from the opposite direction, it reacts just as quickly as though continuously illuminated from one side. The same is true in plants of high tone with stimuli of low intensity. During this first period the plant is merely adjusting its tone to the illumination. This alteration of tone is to be considered as an effect upon the excitable structure itself, produced either by a like or an unlike stimulus. One must distinguish between accommodation or adjustment to a given illumination and *Umschaltung* which determines whether the reaction is to be positive, negative, or none. This *Umschaltung* is dependent on the difference between the existing tone and that corresponding to the intensity of the illumination. If a low-toned plant be brightly lighted it reacts negatively; if weakly, the response is positive. If a high-toned plant is brightly illuminated, it reacts positively; with weak light, it does not respond at all until the tone has fallen far enough, when a positive reaction occurs. The tone in both cases follows the intensity of the illumination, but rises more quickly than it falls. All hypotheses which predicate heliotropic tone as a constant are faulty. The phenomena line up with those already known in certain other organisms and in the human retina, whence it seems probable that they are part of a general physiological law as to light perception.—C. R. B.

Geotropism and heliotropism.—The mutual effect of geotropic and heliotropic stimulation has been the subject of several papers, notably those by WIESNER, NOLL, and CZAPEK. VON GUTTENBERG, working in PFEFFER'S laboratory, has lately attacked the problem whether or not when they operate simultaneously on parallelotropic organs an alteration of geotropic tone occurs.[10] He concludes, contrary to other interpretations, that it does not, finding it possible by choosing an appropriate intensity of light in each case to balance the gravity stimulus without any effect on geotropic sensitiveness itself. Thus in the coleoptile of *Avena sativa* light of about 55 meter-candles, in the hypocotyls of *Brassica Napus, Lepidium sativum,* and *Agrostemma Githago* respectively 525, 666, 1026 m.-c., compensates gravity when each stimulus acts at 90°. When equivalent light acts at right angles to gravity (plants vertical, light horizontal) the parallelotropic organs take a resultant position, departing about 45° from the direction of each. On the elimination of the one-sided action of gravity by the clinostat, however, they become parallel to the light rays; but even in the final position of rest they have not lost their sensitiveness to gravity.

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[9] PRINGSHEIM, ERNST, JR., Einfluss der Beleuchtung auf die heliotropische Stimmung. Beitr. Biol. Pfl. **9**:263–306. 1907.

[10] VON GUTTENBERG, H. RITTER VON, Ueber das Zusammenwirken von Geotropismus und Heliotropismus in parallelotropen Pflanzenteilen. Jahrb. Wiss. Bot. **45**:193–231. 1907.

The geotropic series of reactions is quicker than the heliotropic, when the light is reduced to the compensating point; consequently, when light and gravity act antagonistically, the geotropic curvature appears first, and the maximum of heliotropic stimulation does not appear until much later. While these results are strictly true only for the plants observed, yet the principle is probably valid for others.—C. R. B.

Development of Juniperus.—Two preliminary accounts of fertilization in Juniperus were noted in this journal (**40**:318. 1907). The two accounts differed mainly in regard to time relations, NORÉN stating that the interval between pollination and fertilization was over a year, while SLUDSKY claimed that the development from megaspore to embryo occupies only a single summer. The present account[11] shows that NORÉN was right, SLUDSKY having made a mistake in estimating the age of the cones. The pollen grain in the uninucleate condition reaches the nucellus the middle of June and soon divides into a tube cell and generative cell, the latter remaining undivided until the following May, when it forms the stalk and body cells. Early in July the body cell gives rise to two equal male cells. In the nucellus there are several sporogenous cells, only one of which divides to form megaspores, the others becoming a nutritive jacket about the functioning megaspore. Usually only three cells of the tetrad are formed. In the archegonium there are four neck cells; and a ventral canal nucleus is formed, but never becomes separated from the egg by a wall. Fertilization occurs about the middle of July and the fusion nucleus passes to the bottom of the egg, where three mitoses give rise to eight free nuclei which become arranged in two zones. Walls now appear and the cells of the upper zone divide to form the rosette and suspensor.

The account is very full, cytological details of reduction and fertilization being figured and described.—CHARLES J. CHAMBERLAIN.

Hygroscopic movements of living leaves.—The leaves of some species of Rhododendron exhibit variation movements which follow the recurrence of freezing and thawing weather. The usual position of the leaves is horizontal, with the blade expanded. At freezing temperatures the edges of the leaves curl

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[11] NORÉN, C. O., Zur Entwickelungsgeschichte des *Juniperus communis.* Uppsala Universitets Årsskrift **1907**:1–64. *pls. 4.*